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THESIS

A CASE ANALYSIS OF THE DUAL SOURCING STRATEGY AS USED IN THE ACQUISITION OF THE ARMY'S JAVELIN MEDIUM ANTI-ARMOR WEAPONS PROGRAM

by

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The use of competition during the acquisition of major weapon systems is a key ingredient to mitigating risk and reducing total program costs. One tool the program manager (PM) has at his disposal to ensure competition is viable is dual sourcing. Since the 1960's, PMs have continuously considered the advantages and disadvantages of dual sourcing when developing their acquisition strategy. However, in the past few years dual sourcing as an overall program strategy has come close to being abandoned. Sole source procurement, especially in the production phase of major weapon systems, has returned as the norm. It appears the cause for this can be directly traced to the large force drawdowns, reduced budgets and decreased quantity requirements of the 1990's.

The Army's Javelin program, which began in the 1980's, developed its acquisition strategy around the use of dual sourcing. Dual sourcing within this program has focused both on the overall program level (macro) and at the subcomponent level (micro). The lessons learned and techniques used in this program may provide useful insight for other PMs considering the use of dual sourcing, or within programs facing budget cuts or program downsizing.

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A CASE ANALYSIS OF THE DUAL SOURCING STRATEGY AS USED IN THE ACQUISITION OF THE ARMY'S JAVELIN MEDIUM ANTI-ARMOR WEAPONS PROGRAM

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ABSTRACT

The use of competition during the acquisition of major weapon systems is a key ingredient to mitigating risk and reducing total program costs. One tool the program manager (PM) has at his disposal to ensure competition is viable is dual sourcing. Since the 1960's, PMs have continuously considered the advantages and disadvantages of dual sourcing when developing their acquisition strategy.

In the large procurements of the late 1970's and 1980's dual sourcing paid big dividends in reducing program costs and mitigating risks in schedule and performance. However, in the past few years dual sourcing as an overall program strategy has come close to being abandoned. Sole source procurement, especially in the production phase of major weapon systems, has returned as the norm. It appears the cause for this can be directly traced to the large force drawdowns, reduced budgets and decreased quantity requirements of the 1990's.

The Army's Javelin program, which began in the 1980's, developed its acquisition strategy around the use of dual sourcing. Dual sourcing within this program has focused both on the overall program level (macro) and at the subcomponent level (micro). The lessons learned and techniques used in this program may provide useful insight for other PMs considering the use of dual sourcing, or within current programs facing budget cuts or program downsizing.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

The development of an acquisition strategy is one of the first priorities for the program manager (PM) of a newly formed program. This strategy, although flexible, will lay the foundation for the entire life cycle of the program. There are numerous alternatives or approaches to strategy formulation available to the PM. However, all of the options will take into consideration the effect of competition on the procurement.

The use of competition during the acquisition of major weapon systems is one of the key ingredients to mitigating risk and reducing total program costs. One tool the program manager (PM) has at his disposal to ensure competition is viable is dual sourcing. Since the 1960's, PMs have continuously considered the advantages and disadvantages of dual sourcing when developing their acquisition strategy.

In the large procurements of the late 1970's and 1980's dual sourcing paid big dividends in reducing program costs and mitigating risks in schedule and performance. However, in the past few years dual sourcing as an overall program strategy has come close to being abandoned. Sole source procurement, especially in the production phase of major weapon systems, has returned as the norm. It appears the

cause for this can be directly traced to the large force drawdowns, reduced budgets and decreased quantity requirements of the 1990's.

The Army's Javelin program, which began in the 1980's, developed its acquisition strategy based on the use of dual sourcing. Dual sourcing within this program has focused both on the overall program level (macro) and at the subcomponent level (micro). Dual sourcing has specifically been used in the following areas of the program: 1) technology selection/Proof of Principle (POP) and fly off, 2) EMD/teaming for split production, and 3) Subcontracting of critical items within the Joint venture. The lessons learned and techniques used in this program may provide useful insight for other PMs considering the use of second sourcing, or within programs currently following a dual sourcing strategy and facing either budget cuts or program downsizing.

B. AREA OF RESEARCH

The area of research for this thesis is the use of dual sourcing in the acquisition of the Army's Javelin Medium Anti-armor Weapon System. The thesis addresses the use of dual sourcing as an acquisition strategy tool to mitigate risk at different levels in the program.

C. RESEARCH QUESTIONS

1. Primary Research Question

What were the lessons learned from the use of dual sourcing at different levels and stages in the Javelin program?

2. Subsidiary Research Questions

a. Why is competition important in acquisition planning and strategy formulation?

b. What is dual sourcing and when is its use advantageous in major systems acquisitions?

c. How did the Javelin program office incorporate dual sourcing into its acquisition strategy?

d. How can dual sourcing continue to provide benefits for Program Managers in programs like Javelin which undergo downsizing and budget cuts during program execution?

D. SCOPE

This thesis is a case study of the use of dual sourcing during various stages in the Army's Javelin program. The study analyzes the advantages and disadvantages of dual sourcing in each of these stages and touches on the application of dual sourcing during the program's downsizing during the 1990's. This study is limited to major systems acquisition as currently practiced by the Department of

Defense (DOD). Furthermore, the study touches on the importance of competition in the acquisition process.

E. METHODOLOGY

The information discussed and analyzed in this study was obtained from numerous sources to include: 1) currently available literature, 2) telephonic and electronic mail, 3) personal interviews with the program office and personnel familiar with acquisition procedures. The literature search included the Naval Postgraduate School Library, Defense Technical Information Center, Defense Logistics Studies Information Exchange, articles, journals, periodicals, system documentation provided by the program office, and applicable directives and instructions governing the acquisition process.

F. BENEFITS OF THE STUDY

This study serves as a basis for future research and discussion on the use of dual sourcing at different levels in a major developmental weapon system during times of drawdown, reduced budgets and smaller quantity purchases.

G. ORGANIZATION

This thesis is organized in the following manner:

Chapter I discussed the purpose and focus of the thesis, identified the research questions, and defines the scope of the thesis.

Chapter II presents a brief background on the advantages of competition in Government acquisitions.

Chapter III discusses dual sourcing strategies, advantages and disadvantages. Furthermore, it lays the groundwork for analyzing dual sourcing strategies.

Chapter IV provides an overview of the Javelin program and the acquisition strategy followed by the Program Office.

Chapter V is an analysis of the use of dual sourcing in the Javelin program with the intent of identifying the lessons learned in the following areas: 1) technology selection/ Demonstration/Validation and fly off, 2) EMD/Teaming for split production, and 3) Subcontracting within the Joint Venture.

Chapter VI contains a summary of the principal findings of the research and recommendations for future research.

II. COMPETITION WITHIN DOD

A. INTRODUCTION

When forming an acquisition strategy, it is important to consider the implications of competition. Competition during the acquisition of major weapon systems can have a dramatic effect on many different areas. Advantages which can be derived from competitive procurement include: [Ref. 15:p. 11]

- Obtaining a lower price for a product
- Obtaining a higher quality product
- Expanding the industrial base
- Providing more than one source for product innovation
- Stimulating research and development
- Encouraging receptiveness to the concerns of the buyer and to address criticisms
- Obtaining lower Life Cycle Costs (LCC)

Early identification and planning by the Program Manager (PM) during the formation of the acquisition strategy and plan are the first steps to ensuring competition throughout the procurement process. However, close monitoring of the plan and the contracting environment must be maintained to ensure the competition is not restricted.

B. COMPETITION DEFINED

There are numerous definitions of competition. Most of them involve words to the effect of "rivalry among two or more independent forces." In a competitive market there are usually many buyers and sellers. The interaction between the two tends to lead to an established market price which is usually "fair and equitable" to both the buyer and seller. In most cases, however, in the defense market there is only one buyer, which is known as a monopsonistic situation. This, coupled with the fact that there are few sellers for major weapon systems and high barriers to entry into the market, has lead to defense market competition being concerned mainly with obtaining product quality, production capability and timely delivery at a reasonable price. [Ref. 6:p. 5-2]

DOD competition is categorized in two primary ways: (1) design competition and (2) production competition.

Design competition takes place from concept exploration through the EMD phase of the acquisition process. It includes two or more companies developing their unique way of solving the requirements as specified in the solicitation. One or more of these companies may be chosen to develop a prototype. The development of a prototype serves three purposes: (1) it provides a hands on working

model which can be tested to ensure it is what the buyer wants, (2) it proves producibility of the contractor's design, and (3) prototypes can be used in competitive decision making/source selection.

Production competition, much like design competition, involves two or more companies. However, in production competition the competitors are vying for all or a portion of a production contract. Production competition may take place at the end of the EMD phase for source selection, or it may take place during full scale production in order to bring in a second source. Production competition may also take place in cases where DOD has design specifications and is soliciting for one or more contractors to produce the item.

C. ADVANTAGES TO COMPETITION WITHIN DOD

The Navy Competition Handbook provides an excellent introduction to competition and the competitive goals within DOD. The handbook states, "The primary goal of our competition program is to intelligently apply competition to enhance the responsiveness of our industrial base in order to obtain improved quality, a more vibrant industrial base and increased cost consciousness." [Ref. 10:p. 1] It stresses the use of intelligent competition (where it makes

good business sense) instead of competition for competition sake only.

Some of the advantages of competition were identified at the beginning of this chapter. A short discussion of each one follows:

1. Obtaining A Lower Price For A Product

This is the underlying principle of competition as identified in economic analysis--to get the lowest price possible. If only one company produces a product, that company can set his own price. As more companies enter the market, price tends to be driven down until an equilibrium between price and quantity demanded is reached.

2. Obtaining A Higher Quality Product

Not only does increased competition drive prices down, it also causes companies to compete in areas other than price such as quality. When many producers are in a market, "differentiation" of product may become as important as price. Differentiation is the process of separating a product from another product, usually a competitor's, by pointing out subtle differences such as color, size, cost or use. Quality is often the prime way companies differentiate their products. [Ref. 12:p. 245]

3. Expanding the Industrial Base

In times of national emergencies and mobilization, DOD may require surge capability for quick buildup or replacement of war-damaged equipment. Furthermore, especially in highly technical areas it is advantageous for DOD to maintain more than one source. Competition ensures these capabilities are available. It may require DOD involvement to maintain competition.

4. Stimulating Research and Development and Providing More Than One Source for Product Innovation

When competition exists between companies, as identified in (2) above, price may be only one factor a buyer considers. To ensure success, companies must maintain the edge over competitors. This requires continual research and development to improve the product and to introduce innovative solutions to existing problems. The buyer benefits from this competition through new products and product improvements. [Ref. 25:p. 301]

5. Encouraging Efficiency

While companies should strive to be efficient, as increased efficiency leads to greater profit, not all companies focus on efficiency. Companies which dominate or are a sole source in a market tend, on occasion, to not operate as efficiently as possible. Competition reverses this tendency. Companies who do not continually improve

efficiency in a competitive market will be driven out by lower priced, higher quality products. [Ref. 26:p. 427]

6. Encouraging Receptiveness to the Concerns of the Buyer and to Address Criticisms

Without competition a seller may take the stance of "take it or leave it." Competition, on the other hand, lends itself to opening the seller up to the concerns of the buyer. Each company wants to develop its products to meet the needs of the buyer.

7. Obtaining Lower Life Cycle Costs (LCC)

Life Cycle Costs have become an important determination in DOD source selection in the past twenty years. Competition decreases LCC through reduced prices, availability of sources, lower maintenance costs, and spares availability to name a few. [Ref. 25:p. 254]

D. DISADVANTAGES TO COMPETITION WITHIN DOD

Competition is not always advantageous within DOD. The advantages as well as the disadvantages of competition must be considered by the PM when addressing acquisition planning and strategy formulation. The following is a list of inherent disadvantages to competition which must be considered: [Ref. 16:p. VII-2]

1. Increased Investment Costs

DOD may face increased costs in maintaining competition through additional investment in tooling, equipment and the

administrative burden of managing more than one contractor. Government-Furnished Property (GFP) must also be considered. Competition may mean twice as much GFP will be required.

2. Economies of Scale

Maintaining competition, especially during production, may require the splitting of contracts between two or more contractors. By not buying from one contractor, DOD may not be able to take full advantage of lower unit costs, benefits of learning and high-rate production which are inherent with large buys. This is especially key in major weapon acquisitions where smaller quantities are usually needed.

3. Increase in the Procurement Administrative Lead Time (PALT)

The time which may be required to develop competition coupled with the additional administrative requirements of working with one contractor versus more than one can lead to increased time between when the contracting officer receives a requirement until a contract is awarded. [Ref. 25:p 119]

E. COMPETITION IN CONTRACTING ACT

The Competition in Contracting Act, (CICA), Public Law 98-369, was passed by Congress in July of 1984. CICA, most notably, altered the way the Government conducts procurements. The act required the use of "Full and Open" competition. FAR part six defines full and open competition

to mean that all responsible sources are permitted to compete for a contract action. [Ref. 25:p. 123] Government agencies are required to use competitive procedures in the procurement of goods and services to their best extent possible.

The old procurement procedures of formal advertising and negotiations were replaced with the procedures of sealed bidding and competitive negotiations, (now called competitive proposals). Sealed bidding and competitive proposals were given equal footing under CICA. In other words it is up to the acquisition official to decide which method to use. CICA does lay out that sealed bidding, although not required, is the preferred method and should be used if the following four conditions are present: (1) there are adequate specifications available, (2) there is more than one qualified supplier willing to compete and perform the contract, (3) there is sufficient time available, (4) price can be used as an adequate basis for determining the source to be awarded the contract.

CICA also identified seven exceptions to full and open competition. If any of these seven exceptions are identified in a procurement, then the procurement may be awarded on a noncompetitive basis. The following is a list of the seven exceptions to competition as laid out under

CICA: (1) only one source is available, (2) unusual or compelling urgency, (3) to maintain or establish the industrial base, (4) mandated by international treaty, (5) expressly authorized by statute, (6) purpose or interest of national security, (7) when deemed to be in the public's best interest. [Ref. 25: p. 125]

CICA established the requirement for a competition advocate in every procurement shop. The competition advocate's sole responsibility is to review every procurement to ensure competitive procedures are used to the maximum extent possible. It is the competition advocate who will decide whether a procurement meets one of the seven exceptions listed above.

To even further competition, CICA allows the agency heads to exclude individual sources from competitive procedures in order to develop or maintain an alternative source or sources of supply. [Ref. 15:p. 29] This exclusion of a dominant source of supply helps encourage new competitors to enter the market, thus increasing competition on future contracts.

CICA's other benefits to competition are too numerous to list in this study. It is important at this point, however, to establish that CICA mandated competition. Minus the exceptions listed above, full and open competition has

been the norm for all Government procurements since 1984. The mandate for competition is further outlined in DOD Directive 5000.1, "Defense systems, subsystems, equipment, supplies and services shall be acquired on a competitive basis to the maximum extent practicable as a means of achieving cost, schedule and performance benefits." [Ref. 8:p. 2]

F. ACQUISITION STREAMLINING

In the past several years attempts have been made to try to shorten the acquisition process. The Federal Acquisition Streamlining Act of 1994 is one of the first major Acts to try and accomplish this task. The Act tries to shorten the standard procurement process by moving away from detailed specifications (specs) in favor of performance based specs and the requirement for military standards in favor of commercial standards. [Ref. 21:p. 2]

The Act further establishes the procurement of commercial items as the preference. It states "To the maximum extent practicable, contract requirements and market research should facilitate use of commercial items." [Ref. 19:p. 18-19]

DOD 5000.2 provides guidelines in the area of streamlining also. It recommends the following actions to streamline the acquisition process: [Ref. 9:p. 10-C-2]

1. Requirements shall be stated in terms of performance rather than design specs.

2. Management data requirements shall be limited to those essential for effective control.

3. Design solutions and specifications, standards, and related documents shall not be applied prematurely.

4. Nondevelopmental items shall be used to meet requirements whenever possible.

5. Early industry involvement in the acquisition process shall be encouraged to take advantage of industry expertise to improve the acquisition strategy.

G. SUMMARY

This chapter defined competition and outlined the advantages and disadvantages it offers acquisition officials. These advantages and disadvantages must be considered when forming an acquisition strategy. The chapter also identified the necessity and requirement for competition within the Department of Defense. CICA is the primary acquisition law establishing full and open competition for all Federal procurements. Seven exceptions to this law are also laid out in this chapter. Lastly, this chapter discusses new initiatives being implemented to shorten the acquisition process.

III. DUAL SOURCING

A. INTRODUCTION

In order to assist the PM in maintaining or creating competition, the acquisition strategy is very important. The strategy can be a tool to creating competition, thus procuring a quality system at a fair and reasonable price. One of the most predominant strategies used to increase competition and reduce risk and life cycle costs is dual sourcing.

Dual sourcing has been used within DOD since the 1960's. "During the 1960's and 1970's, the strategy was not generally used to establish a second source during program development, as it is used today. Instead, the strategy was typically used to establish a second source after a weapon system moved into the production phase". [Ref. 5:p. 9] DOD Instruction 5000.2 identifies competitive alternative sources as a mandatory consideration to develop a competitive environment in Acquisition Category I (ACAT I) programs. [Ref. 9:p. 5-A-2]

The decision to use dual sourcing should be made as early in the program as possible. This will give the PM time to analyze the advantages and disadvantages to each recognized dual source technique, and to choose the approach

which best fits the program objectives. Early identification of dual sourcing also enables the contractors to plan accordingly, and it provides realization to the contractors that competition will be a factor. This early identification is paramount in later stages when a winning contractor may be asked to assist in the development of a second source. [Ref. 24:p. 21]

There are five major accepted techniques to establish and maintain dual sources. They are: (1) Form-Fit-Function (F^3), (2) Technical Data Package (TDP), (3) Directed Licensing (DL), (4) Leader-Follower (L/F)and (5) Competitive Contractor Teaming (CCT). [Ref. 24:p. 13]

B. FORM-FIT-FUNCTION (F^3)

This method of dual sourcing involves the introduction of a second production contractor without the need for technical transfer of production specifications or drawings between production sources. The second source is given performance/functional specifications and parameters such as overall performance, weight, size, external configuration, mounting requirements and interface requirements. This is the classic engineering concept of the "black box" where exact internal specifications for the production of the product are not required. [Ref. 24:p. 22]

Since there is no technology transfer between contractors under this technique, the PM must ensure that the equipment specifications are clearly and completely defined. These specifications should include: [Ref. 7:p. 9-3]

1. External dimensions of the equipment
2. Interface requirements
3. Power requirements
4. Equipment performance requirements

F^3 is unique from the other four in that it is the only one which allows and even to some point encourages internal configuration differences between the contractors' designs. It must be kept in mind though when considering this technique that logistical costs may rise due to the differences in equipment. This strategy is considered exceptional for second sourcing subcomponents which require less technical expertise than is required for the entire system.

The primary advantages to Form-Fit-Function are: [Ref. 24:p. 13]

1. The contractor has the primary responsibility for detailed design. This places the risk of performance on the contractor.

2. Since the contractor is building to meet performance specs, there is no need for a technical design package.

3. Government monitoring of contractor and Government technical capability requirements are minimal.

4. Interface between the two competing contractors is not required; each contractor is free to be innovative in his approach to meeting the requirements.

5. Interoperability between products from multiple sources can be achieved.

6. Unit production cost reductions are possible due to competition, especially with parallel development.

The associated disadvantages of this method include the following: [Ref. 24:p. 14]

1. Development effort is required for each procurement, unless it is an off-the-shelf item. This means that additional time and money is required each time this approach is used.

2. Source selection criteria must be stringently developed to weed out the contractors who do not have complete understanding for the requirements. As is usually the case, low bidders may not fully understand the implications of the requirements.

3. Spare parts, unless provided for under total life cycle support, may be highly priced based on the contractor's market position.

4. Time must be taken to develop exact specifications. Otherwise you could wind up with two different products which are not interchangeable and require separate logistical support.

5. This approach should not be used where there is instability in the performance requirements of the system being procured.

C. TECHNICAL DATA PACKAGE (TDP)

TDP involves the utilization of a stand-alone technical data package to solicit proposals from alternative manufacturers. These manufacturers may or may not have originally been involved in the development or production of the system. [Ref. 24:p. 14] The key to a TDP is that the information be as complete and well documented as possible. TDPs may be obtained through the data rights clause which are outlined in the Federal Acquisition Regulation. This clause outlines the rights the Government will request when engaged in a development program. These rights could be limited, that is proprietary or data relating to standard commercial items do not have to be furnished, or the rights could be unlimited, that is all data concerned with the production of the item must be provided. [Ref. 2:p.9-7] If the TDP was not originally provided for under this clause, the Government may not have a legal right to get the contractor to provide it, and may not be able to obtain it (not at a reasonable price at least).

TDP is best used in situations where the item is of low to moderate complexity since the second source must interpret the production plans without the assistance of the original developer. Technology transfer is achieved strictly on the basis of the TDP with no direct contractor-

to-contractor exchange. The key criterion in determining whether to use TDP or not is that the system technology be such that it can be adequately presented as drawings, specifications, parts lists, and processes. [Ref. 7:p 10-1]

The following are advantages to using TDP: [Ref. 24:p. 14]

1. Once the Government owns and has validated the TDP, it can be used repeatedly in maintaining a competitive atmosphere throughout the life cycle of the acquisition.

2. The TDP, once validated, allows for simple second sourcing. This technique may be used to inject competition at any time in the acquisition.

3. There is no need for a contract between the contractors.

4. Substantially reduces the technical, schedule and cost risks of technology transfer, depending on the level of validation. [Ref. 10:p. 37]

5. In-house Government technical expertise is developed.

Disadvantages include the following: [Ref. 24:p. 14]

1. It is difficult to obtain a TDP that is adequate enough alone to transfer complex techniques.

2. The Government must maintain a qualified team to validate and update the TDP.

3. Technology differences/manufacturing processes between companies may make it impossible for one company to follow the TDP of another.

4. Production competition not usually achievable until the third year of production. [Ref. 10:p. 37]

5. Government accepts responsibility for defects in the data package.

D. DIRECTED LICENSING (DL)

Directed licensing (DL) is similar to TDP in that technical transfer of data takes place. However, in DL the technical data are transferred directly from the initial contractor (licensor) to the second source (licensee). The licensor, in addition to the TDP, also provides the licensee with technical assistance, "know-how", in producing the item. In return the lisensor receives a "Royalty fee" for each item that the licensee produces.

This approach is often used in cases where the original source has patent rights on certain designs or processes. Since a royalty fee is paid for each item produced by the second source, this approach is usually used on programs for reasons other than cost reduction. [Ref. 10:p. 42] If the Government plans to use DL, it is wise to negotiate this into the initial contract during early development. DL is mostly used to reopen competition for follow-on production.

The advantages of DL include: [Ref. 24:p. 15]

1. The potential, or threat to initial contractor, for competition is maintained throughout the life cycle of the product.

2. Minimal involvement of the Government is required for the technology transfer.

3. The initial designer is protected as to what markets the second source may compete in.

4. Utilizes unique developer capabilities.

Disadvantages of DL include: [Ref. 24:p. 15]

1. The overall benefit to the Government may be limited due to Royalty and technical assistance fees.

2. The licensor may not cooperate fully with the licensee.

3. The licensee may bid on the contract to merely obtain proprietary information on the licensor.

4. The cost of motivating/incentivizing the developer to participate may be high.

5. There is a potential for complex contractual relationships between the parties which will make it hard to maintain Government control.

E. LEADER-FOLLOWER (L/F)

The leader-follower (L/F) technique is similar to DL in that it involves the direct transfer of technical data and assistance from one contractor to another. However, in the L/F technique the initial contractor does not receive a Royalty fee. [Ref. 24:p. 15] The leader provides training, technical assistance, material support, vendor qualification and detailed manufacturing support to the follower. The follower can be established as a subcontractor to the leader or both can be prime contractors to the Government. [Ref 10:p. 37]

The L/F approach is best employed on items of moderate to high complexity where two sources are needed early on in the production phase to meet high delivery requirements. This strategy is not intended to be used in the acquisition of items where the technology is widely known and understood. The FAR, Subpart 17.4, identifies this technique as extraordinary and restricts its use to the following: [Ref. 13:p. 17-10]

1. The leader company possesses the know-how and is able to furnish requisite assistance to the follower.

2. No other source of supply can meet the Government's requirements without the assistance of the leader company.

3. Leader company assistance is limited to that required to enable the follower company to produce the item.

4. The Government reserves the right to approve contracts between the leader and follower.

The advantages of L/F are similar to those of the DL. The major disadvantages are that no Royalty fees are provided for the leader. This may lead to less enthusiasm on the part of the leader to perform. Furthermore, the procedure provides less proprietary data protection for the leader. [Ref. 23:p. 29]

F. COMPETITIVE CONTRACTOR TEAMING (CCT)

This process involves two contractors pooling resources during the development phase to design the acquisition. Each contractor may develop his own subsystems, however, he must share that information with the other team members. This direct contractor-to-contractor exchange of information relieves some of the burden off the program office. At the completion of development, each contractor must be able to produce the item independently of the other contractor.

In order for the CCT approach to be successful, a high degree of concurrency between development, technology transfer and initial production must exist. Therefore the CCT is best employed in systems acquisitions where there are high value items with multiple internal interfaces, moderate technical risk and a large initial production rate requirement. [Ref. 10:p. 41]

This teaming strategy can be arranged through a prime-subcontractor relationship, or it can take place as a joint venture. As a joint venture, each company provides assets to form a distinct entity separate from the parent company. This entity (or company) places the two contractors on equal terms as partners. Each must rely on the other for critical subsystems and deliveries thus enhancing contractor cooperation. This method has some clear advantages over the

prime-subcontractor relationship. If a joint venture is recommended by the program office, it must be included in the request for proposal (RFP). [Ref. 7:p. 13-5]

The principal advantages of this approach are: [Ref. 24:p. 16]

1. Alternative sources are developed as part of the development process.

2. Eliminates the feeling on the part of the contractors that proprietary information is being given up.

3. Abolishes the need for Royalty or technical assistance fees.

4. Increases the Industrial base.

5. As in any other process "two heads are often better than one". The chance of innovative approaches to the problem may surface from the interaction of two contractors.

6. Reduces the performance risk in very complex systems development. [Ref. 23:p. 36]

7. Lends to production competition early in the production phase.

8. Facilitates the second sourcing of technologically advanced, state-of-the-art systems which, due to technology transfer and proprietary data right problems, could not be second sourced using other second sourcing methods.

The primary disadvantages of CCT are: [Ref. 24:p. 16]

1. Increased costs during the design phase since at least two contractors are involved.

2. Contractor coordination and commitment is a must.

3. It may violate anti-trust regulations.

4. Weak Government leverage to maintain partnerships throughout the technology transfer process. [Ref. 10:p. 42]

5. More difficult to manage due to potential "finger pointing" and/or one partner emerging as the stronger leaving the other as a "weak sister".

G. ANALYZING THE BENEFITS OF DUAL SOURCING

Much has been written on whether dual sourcing as an acquisition strategy indeed reduces lifecycle costs and acquisition risks. A RAND study conducted in 1983 specifically addressed the questions of the effect of dual sourcing on costs and program risks.

According to the study, cost savings from competition are usually outweighed by the increased costs of developing and maintaining the second source. This is brought about due to the decreased economies of scale, lack of fully utilized production capacity, doubling of non-recurring costs, increased amortized fixed indirect costs over a broader base, and a decreased learning curve due to smaller production quantities. [Ref. 3:p 112]

The study did not rule out that cost savings were not possible under some circumstances. In fact it found that out of 18 items procured under a "winner take all" competition that 17 showed cost savings. However, out of 10

items procured using a "split buy" competition only three showed signs of cost savings. The split buys which were successful involved simple items with shallow learning curves and high quantity requirements.

The report found that some areas of production risk were indeed reduced. These areas included technical, management, labor, and plant and capital equipment. [Ref. 3:p. 114] However, the reduction generally was not a major contributor to program success.

Since this study was published in 1983, the Department of Defense has employed dual sourcing strategies successfully on a number of major weapons acquisition programs. The key to success is an effective economic, technical and program analysis to determine if dual sourcing is economically justified or not.

Economic analysis takes place in the following areas: [Ref. 7:p. 4-4]

1. Non-recurring costs.
2. Single source recurring production costs.
3. Original source recurring costs.
4. Second source recurring costs.
5. The effect of production rate on unit production costs.
6. Government administrative costs.

7. Logistical support costs.

8. The use of a discount rate.

Technical analysis takes into account the level and type of technology inherent in the systems design and manufacturing process. Factors considered include: [Ref. 7:p. 5-1]

1. Level and type of required technology.

2. Availability of alternative development and production sources.

3. Status of the technical data package.

4. Potential for technological innovation in design and manufacturing.

5. Plans for future development.

6. Proprietary data.

Lastly, the PM must analyze the effects on the program itself. Assessment of the below areas can provide the PM insight into the correct selection of one of the technology transfer methodologies. The areas to consider consist of the following: [Ref. 7:p. 6-1]

1. Program funding.

2. Program development schedule and risk.

3. Production lead times.

4. Degree of subcontracting.

5. Contracting and legal issues.

6. Program management complexity.

H. SECOND SOURCING METHOD SELECTION MODEL (SSMSM)

The FAR (Part 34 - Major Systems Acquisition) specifies that, "the PM shall, throughout the acquisition process, promote and sustain competition between alternative major systems concepts, as long as it is economically beneficial and practical to do so". [Ref. 13:p. 34-1] The question of when it is economically beneficial and practical to do so and how to accomplish competition within a particular program is at the heart of the PM's acquisition strategy.

Once the PM has decided that dual sourcing is a legitimate strategy consideration, he must weigh his choices as to which dual sourcing strategy best fits the item to be procured. He must consider the advantages and disadvantages of each strategy and try to fit the best one to his program.

The last section touched on areas to consider, which requires indepth analysis, when making decisions. To further narrow the PM's focus prior to analysis, Captain Scott Parry (now Chairman of the Defense Acquisition Regulation Council) in his masters thesis from the Naval Postgraduate School teamed with LCDR Benjamin Sellers to develop two models (a pre-production and post-production model) called the Second Sourcing Method Selection Model

(SSMSM). These models can be used as a preliminary evaluation of the dual sourcing options available. [Ref. 20: p. 68] The pre-production model is used by the PM when he is developing his overall acquisition strategy - i.e. during initial program formulation. The post-production model is for use by the PM when considering bringing in a second source on a program already in the production phase. Each of these models take into account 14 decision variables to assist in the evaluation. These decision variables are:

1. Quantity to be procured.
2. Duration of the production.
3. Slope of the learning curve.
4. Complexity of the system.
5. State-of-the-art.
6. Other potential Government or commercial uses.
7. Degree of privately funded R&D.
8. Cost of unique tooling/facilities.
9. Cost of transferring unique Government-owned tooling/equipment.
10. Contractor capacity.
11. Maintenance concept to be employed.
12. Production lead time.
13. Amount and type of subcontracting.
14. Contractual complexity.

The actual models are presented in FIGURE 1 and FIGURE 2. A "+", "0", "-", is used to denote whether the technique is strong, neutral, or weak in comparison with the decision variables. An "x" is used to denote that the given technique is inappropriate, and an "*", is used to denote that the technique is ideally suited for that variable.

It is critical to note that these models and ratings are only an initial guide to assist a PM in evaluating the techniques. Alternatives which may be identified as weak on the model could be considered strong in some programs due to the flexibility the PM has in tailoring strategies to fit particular programs. The models should be used as a "quick look" prior to thorough evaluation using the techniques described in the previous section.

It is interesting to note that the five dual sourcing methodologies are listed across the top of the model in the order of F^3, TDP, DL, L/F and CCT. When placed in this order, these methodologies represent the amount of cooperation and contact needed between the original developer and the second source. For example F^3 requires less contact and cooperation between contractors than CCT. [Ref. 20:p. 68]

Variables		Methodology F3	TDP	DL	L/F	CT
Quantity	High	+	+	+	+	+
	Medium	+	+	o	o	+
	Low	o	o	-	-	o
Duration	Long	+	+	+	+	+
	Medium	+	+	o	+	+
	Short	o	o	x	x	o
Learning Curve	Steep	-	-	-	o	o
	Flat	+	+	+	+	+
Technical Complexity	High	o	x	+	+	*
	Medium	+	-	+	+	+
	Low	+	+	+	+	+
State of the Art?	Yes	o	x	+	+	*
	No	+	+	+	+	+
Other Application	Yes	+	o	+	o	+
	No	+	+	+	+	+
Degree of Private R&D	High	o	x	o	x	-
	Low	+	o	+	+	+
Tooling Costs	High	-	-	-	-	x
	Low	+	+	+	+	+
Govt. Tool Transfer Cost	High	o	o	o	o	o
	Low	+	+	+	+	+
Contractor Capacity	Excess	-	-	-	-	-
	Deficient	+	+	+	+	+
Maintenance Requirement	Significant	x	o	o	o	o
	Minimal	+	+	+	+	+
Production Lead Time	Long	-	-	-	-	-
	Short	+	+	+	+	+
Degree of Subcontracting	Heavy	o	-	-	-	-
	Light	+	+	+	+	+
Contractual Complexity	Complex	-	-	-	-	-
	Simple	+	+	+	+	+

FIGURE 1 - SSMSM (Pre-Production Model)

Source: [Ref. 20:p. 77]

Variables		Methodology F3	TDP	DL	L/F	CT
Quantity	High	+	+	+	+	+
	Medium	+	o	o	o	o
	Low	o	x	-	-	-
Duration	Long	+	+	+	+	+
	Medium	+	o	o	o	o
	Short	o	x	x	x	-
Learning Curve	Steep	o	o	o	o	o
	Flat	+	+	+	+	+
Technical Complexity	High	o	x	+	+	+
	Medium	+	-	+	+	+
	Low	+	+	+	+	+
State of the Art?	Yes	o	x	+	+	*
	No	+	+	+	+	+
Other Application	Yes	+	-	+	o	+
	No	+	o	+	+	+
Degree of Private R&D	High	o	x	o	x	o
	Low	+	o	+	+	+
Tooling Costs	High	-	-	-	-	x
	Low	+	+	+	+	+
Govt. Tool Transfer Cost	High	o	o	o	o	o
	Low	+	+	+	+	+
Contractor Capacity	Excess	-	-	-	-	-
	Deficient	+	+	+	+	+
Maintenance Requirement	Significant	x	o	o	o	o
	Minimal	+	+	+	+	+
Production Lead Time	Long	-	-	-	-	-
	Short	+	+	+	+	+
Degree of Subcontracting	Heavy	o	-	-	-	-
	Light	+	+	+	+	+
Contractual Complexity	Complex	-	-	-	-	-
	Simple	+	+	+	+	+

FIGURE 2 - SSMSM (Post-Production)

Source: [Ref. 20:p. 78]

I. SUMMARY

This chapter has provided an introduction to dual sourcing and the five methodologies available for the PM to consider when structuring the acquisition strategy. The chapter also outlined the advantages and disadvantages of each approach. To assist the PM in determining whether dual sourcing is advantageous to his specific program, this chapter discussed the use of economic, technical and program analysis. However, this analysis may take some time to accomplish. The PM can use the SSMSM model as a quick check in identifying specific dual sourcing methodologies which are advantageous to his program.

IV. JAVELIN SYSTEM OVERVIEW

A. BACKGROUND

The Javelin weapon system is a medium-range, man portable, imaging infrared, fire and forget, antitank weapon system designed to replace the current DRAGON system. The system will be capable of defeating current and future armor in day or night engagements out to a requirement range of 2,000 meters. It will have an additional engagement capability against helicopters and bunkers. The system features a top attack mode for tanks and a direct fire option for targets that are under cover or in bunkers. [Ref. 18:p. J-1] The Javelin is being developed for the Army and Marine Corps, and remains a high priority in the Army's modernization efforts.

Javelin consists of two major components: The missile and the Command Launch Unit (CLU). The missile is an expendable, self-contained unit consisting of a seeker, guidance system, tandem warhead and electronic fuse, propulsion unit, control actuator system and disposable launch tube. It employs a "soft launch" feature which allows it to be fired from enclosures or covered fighting positions with minimum launch signature. This minimum launch signature reduces the gunner's vulnerability to

counter fire. The missile has an expected shelf life of at least ten years and requires no field level repair or maintenance. Since field level repair and maintenance are not required, the missile is often characterized as a "wooden round". It weighs approximately 35.3 lbs. [Ref. 18:p. C-13]

The CLU is a reusable item of the system. It consists of an integral visible day telescope and a long wavelength infrared night sight with wide and narrow fields of view, a round mating latch, a battery box/power connector, a test connector and a hand grip/control housing. A monocular eyepiece assembly allows the user to view the CLU night sight video, missile seeker video, day telescope, and system status information. The CLU is used for battlefield surveillance, target acquisition, missile launch and damage assessment. It weighs approximately 14.2 lbs. [Ref. 1:p. 40]

The program management office, in 1986, developed the program acquisition strategy with the objective of obtaining competition during each phase of the program. These phases consisted of a Demonstration/Validation (DEM/VAL) and fly-off phase, an EMD phase, and a competitive production phase.

B. DEMONSTRATION/VALIDATION (DEM/VAL) AND FLY-OFF

The Javelin program began DEM/VAL in August 1986 with a 27-month proof-of-principle (POP) and fly-off phase to evaluate three technology concepts: the Laser Beam Rider System by Ford Aerospace and Communications Corporation, the Imaging Infrared Seeker with Fiber Optic Guidance by Hughes Aircraft Company, and The Imaging Infrared Fire and Forget Seeker by Texas Instruments, Inc. Each of these candidates was chosen through full and open competition, and were awarded a $30 million firm-fixed price (FFP) contract to develop a prototype and demonstrate performance. [Ref. 18:p. C-11] This demonstrated performance was expected to provide a key ingredient to overall program risk reduction. Competition for the EMD phase was limited to the three POP contractors.

At the end of the POP, a fly-off was conducted to determine which system would best meet the user's needs and technology requirements, as well as, offering the best cost, schedule and performance risk. Due to budgetary constraints only one system would be chosen to continue into the EMD phase.

C. ENGINEERING AND MANUFACTURING DEVELOPMENT (EMD)

1. General

The EMD phase was structured to provide two qualified sources for full rate production (FRP) by requiring the POP contractor chosen for EMD to select a teammate having the capability to produce the system and perform as a system prime contractor. [Ref. 18:p. C-10] This requirement established the strategy of competitive contractor teaming (CCT), more specifically joint venture (JV), in EMD.

The Javelin program possessed all the qualities which were advantageous to CCT/JV. The product was a technologically advanced, state-of-the-art procurement that required large production quantities in a short period (6 production years). It was estimated that the total Army requirements would be 58,000 missiles and 5000 CLUs. The Marine Corps estimates were 12,550 missiles and 1486 CLUs.

The EMD phase was initiated in June 1989 with a cost-plus-incentive-fee (CPIF) contract award to the joint venture of Texas Instruments (TI)/Martin Marietta (MM). This contract also included an option for two low rate initial productions (LRIP). The idea behind this acquisition strategy was that TI and MM would co-develop the product, prove production capability during the LRIPs and compete head-to-head during the FRP for a 60/40 split. This

would provide the economical benefits of competition and risk reductions which are so desired in DOD acquisitions. This teaming arrangement and responsibilities are laid out in FIGURE 3.

2. Responsibilities

The acquisition strategy centered around placing the responsibility of the EMD phase firmly on the shoulders of the JV. The joint venture would manage all subcontracting, and Government-Furnished Property would be minimal. A president for the JV was appointed from TI and a vice president from MM.

The JV agreement included a technology transfer plan (TTP). This TTP outlined the responsibilities of each party with respects to the sharing of technological and manufacturing information. Under this agreement each party agreed to provide the other nonproprietary form, fit and function information sufficient for a qualified second source to produce the item as well as the necessary assistance to avoid excessive experimentation and design costs. [Ref. 18:p. C-10]

TI specifically took the responsibility for the EMD systems integration. They also were the lead for the CLU, array processor, image digitization and correction, and the missile central processor guidance electronics. MM took the

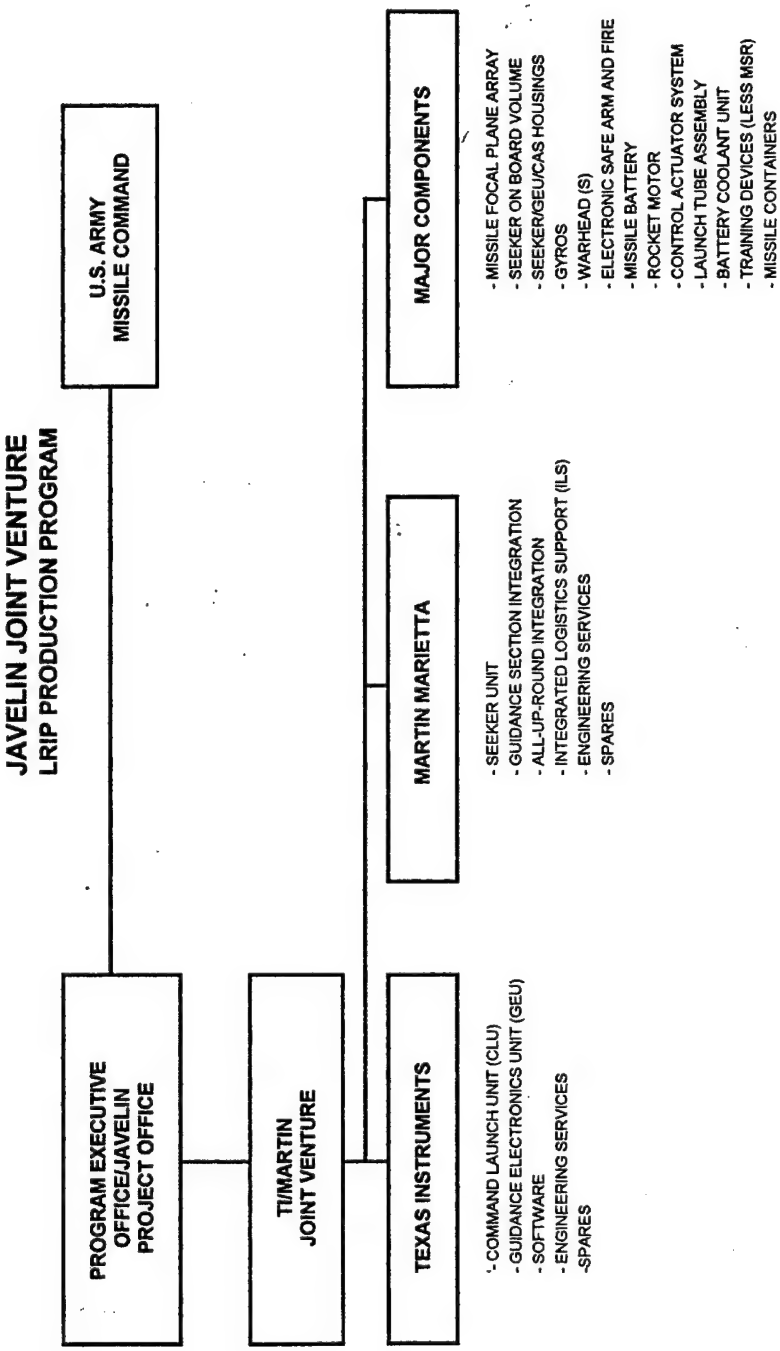

FIGURE 3 - Javelin Joint Venture Program

Source: [Ref. 1:p. 10]

lead in developing the battery coolant unit (BCU), missile and BCU batteries, cryostat, rate sensor, launch tube assembly, seeker focal plane array (FPA), electronic safe, arm, and fire (ESAF) device, propulsion system, warhead, control actuation system, power distribution assembly and missile guidance electronics and training devices. MM, furthermore, took the lead for integrated logistics support. [Ref. 18:p. C-12]

The Government, more specifically the PMO, maintained the overall contractor management responsibility. This included ensuring the JV functioned according to the established agreement. The Program Managenebt Office (PMO) also maintained responsibility for the Government lead testing.

3. Critical Components

The initial acquisition strategy outlined the requirement for two independent qualified sources for items on the Critical Items List. The purpose of having a second source for these items were reduced development risk and reduced unit production costs through competition. Two critical items identified as needing a second source were the FPA and the ESAF. This requirement was brought about due to the high technical risk and cost. During the EMD phase, three other items were identified as candidates for

second sourcing. These items included the launch tube assembly (LTA), the rate sensors (often called the gyro), and the on-board vessel (OBV). Each of these items was second sourced using the F^3 approach.

The missile FPA was considered the top priority technical risk in the system. This critical component was originally supposed to be provided by TI during EMD with a second source to Santa Barbara Research Center (SBRC), a subsidiary of Hughes, to be established by LRIP II. SBRC was a subcontractor for MM. However, TI encountered difficulties in manufacturing a FPA which could meet the sensitivity and detectivity threshold requirements. [Ref. 14]

After continued development efforts and large cost growth, the decision was made to stop funding TI. SBRC, based on F^3 information, had a FPA which exceeded the threshold requirements. They became the primary source, and provided all the EMD FPAs. Since the FPA still required a second source, a solicitation was issued in the summer of 1994. Loral won that contract, and became the second source for the FPA.

The ESAF was considered the primary risk to production schedule. [Ref. 18:p. J-19] Magnavox was the primary source, and Motorola the secondary. The JV has experienced some

management difficulties with Magnavox, however, they continue to be a source at this time. [Ref. 4]

4. Technological and Funding Problems

The Javelin program experienced numerous technical difficulties with the propulsion unit, ESAF, missile and CLU FPA, batteries and system weight which lead to extensive cost overruns and schedule delays. From June 1989 when the EMD contract was awarded to September of 1991, costs grew 2.6 times the original contractor estimate. Furthermore, Javelin as with many other DOD programs was hit hard by the reductions in military budgets and force structure changes. These changes lead to program downsizing.

The total procurement quantities for the Army were reduced from 58,000 to 26,600 missiles (54% decrease) and from 5000 to 2800 CLUs (44% decrease). The Marine Corps experienced a similar reduction from 12,550 to 4669 missiles (63% decrease) and from 1486 to 464 CLUs (69% decrease). This represents a cut of more than half the original quantities. The Marine Corps also postponed their initial procurement from the second production buy (Low Rate Initial Production II) to the fourth buy (FRP I). Furthermore, due to funding restraints, the procurement program was stretched from a 6-year production buy to 10 years and ultimately in

FY94 to 14 years. [Ref. 1:p. 2] FIGURE 4 outlines the 14-year baseline procurement profile as well as estimated program costs.

One of the critical technological problems was the overall system weight. The operational requirements document called for a maximum threshold weight of 45 lbs. After considerable cost expenditure ($5 million at one point to eliminate 28 grams), this weight was classified as not achievable. [Ref. 11] The Joint Requirements Oversight Council redesignated the threshold to 49.5 lbs. This threshold change was approved in an Acquisition Decision Memorandum (ADM), dated 7 December 1990. [Ref. 18:p. H-1] Although still a challenge, this alleviated further cost growth.

The FPA technological problems were also a major factor in program cost growth. [Ref. 14] Costs continued to escalate as TI struggled to meet the requirements. Finally, under guidance from the PMO, the JV abandoned TI as a source for the FPA and went to the proposed second source.

These technological difficulties coupled with the force restructuring and budget cuts rendered the 36-month EMD phase unachievable. In September of 1991, the EMD phase was restructured to 54 months with an additional 24 month

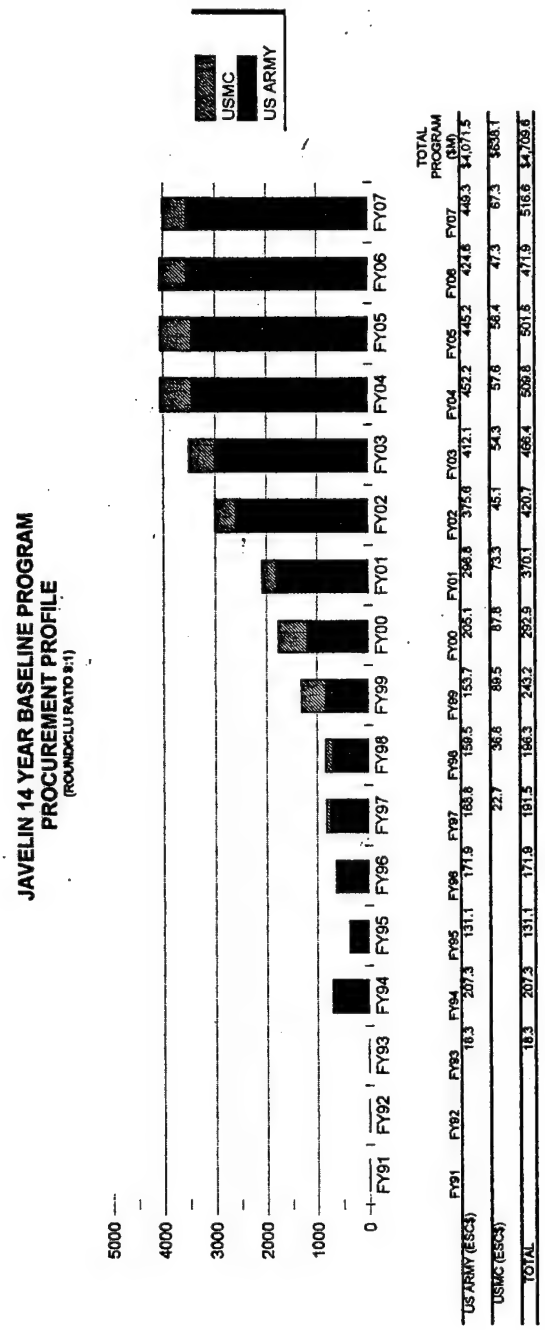

FIGURE 4 - Javelin 14 Year Baseline Program

Source: [Ref. 17]

technical support phase. [Ref. 18:p. J-4] These changes had a dramatic effect on the acquisition strategy.

D. FULL RATE PRODUCTION (FRP)

The purpose of the teaming acquisition strategy was to allow for competition in the FRP phase between the two team members. Following the two LRIPs, where the contractors prove their ability to produce the entire system, the production was to be competed in six single-year production buys. The total quantity requirement along with the short production period was ideal for the teaming arrangement.

The initial plan called for each team member to produce a minimum of 10% of the production quantity during low rate initial production (LRIP) I and 50% during LRIP II. This would qualify each producer. The FRP quantities would then be competed on a 60/40 split where the winner would produce 60% and the loser 40%.

Due to the issues addressed in the section above, the FRP schedule was also dramatically changed. It was extended from six years to ten, from ten to eleven and then from eleven to fourteen years. This program stretch-out coupled with the quantity reductions caused unit costs to skyrocket. Furthermore, the advantages which the teaming arrangement had offered were lessened. [Ref. 1:p. 2]

E. COST CONTROL/RISK REDUCTION IN EMD

Cost control and risk reduction were continually considered in all decision areas of the program. These controls became even more critical with the technical problems and program strategy changes implemented during EMD. In an ADM issued on July 11, 1994, the Deputy Under Secretary of Defense (Acquisition and Technology) requested that the PM investigate cost savings measures and present a Cost Reduction Plan for the program. The Cost Reduction Plan, along with other cost saving measures initiated during EMD, is outlined below. The estimated savings of the initiatives implemented in EMD and FRP is $1.4 billion. These cost saving measures directly impacted the teaming strategy as originally defined.

1. Enhanced Producibility Programs (EPP)

Two EPPs were introduced (through value engineering) during EMD. Both were designed to reduce producibility risk and cost beginning with LRIP I. [Ref. 18:p. C-11] The first EPP, EPP I, was planned as a parallel effort to the EMD phase. EPP I consisted mostly of missile enhancements at a not-to-exceed cost of $24.364 million. Eight enhancements to the missile are included in this program. The estimated total saving of this program are $140 million. [Ref. 17:p. 5]

EPP II was initiated in May 1994 as a direct result of the request for a Cost Reduction Plan. Eleven cost reduction initiatives for the missile and 4 for the CLU were evaluated. The cost for EPP II is $24.5 million, however, the procurement savings it will generate are estimated to be near $226 million. Furthermore, it is expected that EPP II enhancements will reduce operations and support costs as well. [Ref. 17:p. 11]

2. Restructure of EMD Contract

As stated earlier, EMD costs increased by 161% in a relatively short time frame. As part of the cost control, the program office restructured the EMD contract to include a 50/50 cost sharing with the JV if costs increased above a certain threshold. Since cost sharing by the contractor specifically targets profit, this measure was expected to incentivize the contractor to institute their own cost control measures.

The restructuring also increased the number of LRIPs from two to three. This third LRIP was added by direction of OSD to prove producibility of the EPP II changes along with producibility of an alternate warhead. Unfortunately, this additional LRIP delayed FRP an extra year. [Ref. 14]

In November 1992, the acquisition strategy was revised to eliminate the requirement for two competitive sources

during LRIP. Previously each team member was to operate separate production lines to produce a certain percentage of complete Javelin weapon systems. However, due to the unit cost increase, this was considered not to be cost effective. Instead, a consolidated production between the team members where each would continue to produce what they developed, qualified and manufactured during EMD was approved.

3. Streamlining of the Acquisition Process

The restructuring of the EMD contract along with the revised LRIP strategy afforded the program office a chance to analyze cost saving measures through the implementation of acquisition streamlining. Specifically, the PM looked at the advantages of reducing the required number of specifications, standards, regulations and contract data requirements list (CDRL) in the long lead time items contract and the LRIP contracts.

In total, the PM was able to reduce the required number of specifications, standards and regulations from 73 in LRIP I to 23 in LRIP III. CDRLs were reduced from 63 in LRIP I to only 21 in LRIP III. It is estimated that these measures will save approximately $800 thousand in LRIP II alone. [Ref. 1:p. 28]

F. COST CONTROL/RISK REDUCTION IN FRP

Like the cost savings measures considered in EMD, FRP saving measures were also implemented. Cost trade off studies were conducted to analyze the acquisition strategy of competition during FRP. Other aspects of cost savings were instituted as a result of the Cost Reduction Plan. These steps are discussed below.

1. Consolidated Production

In 1993, the program office recommended that the acquisition strategy be revised to continue the JV into FRP without split production. This recommendation was brought about as a direct result of the quantity reductions and increased unit costs. To maintain limited competition, OSD added the stipulation that three bids would be obtained: one from the JV, one from TI, and one from MM. [Ref. 1:p. 34]

2. Schedule Reduction of FRP

In the Cost Reduction Plan, the program office analyzed the effects of reducing the procurement program from 14 years to 11 years. [See FIGURE 5] This plan consisted of stabilizing the annual procurement quantities and accelerating procurement in the near term, the use of multiyear contracting, system level competition, component breakout of selected items, limited competition of components, reinvestment of resultant cost reduction

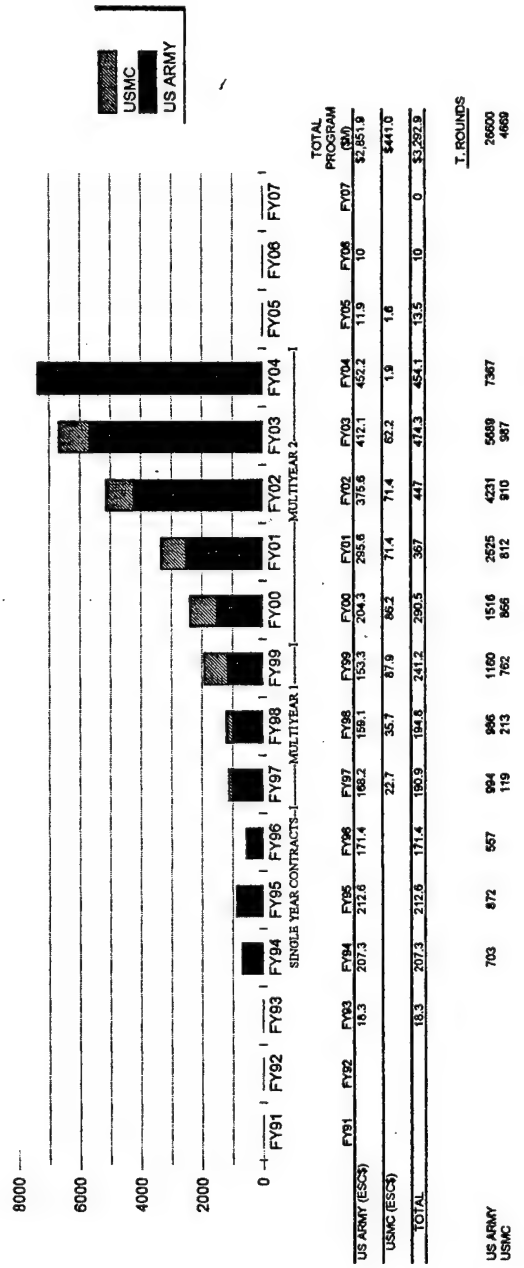

FIGURE 5 - Javelin 11 Year Baseline Program

Source: [Ref. 17]

initiative savings to effect an earlier buy out, reassessing the Joint Services Operational Requirements (JSOR) and contract requirements as well as the other initiatives outlined in section E of this chapter.

In establishing this reduced production schedule, the program office assumed the following actions/events will occur: [Ref. 1:p. 5]

a. Execute the program with dollars programmed in the Program Objective Memorandum (POM) and extended POM annex as of 20 June 94 on a year-to-year basis.

b. Congressional FY95 budget plus-up of $82.9M is approved and allocated/apportioned to the Javelin Program.

c. Approval to use Continuing Resolution Authority for each fiscal year.

d. Reinvestment of year-to-year savings/no reductions to the POM/POM annex.

e. Program authority to procure increased quantity of missiles and CLUs resulting from achieved savings on an annual basis.

f. Cost reduction savings will be realized as the program proceeds.

3. Multiyear Procurement

Further cost reductions are expected from the use of multiyear procurements. The plan is to use three LRIPs

followed by two multiyear contracts. It is estimated that the use of multiyear contracts could reduce costs by almost $500 million. [Ref. 17:p. 13]

4. Component Breakout

Several components have been earmarked as possible candidates for component breakout. These items would be obtained by the Government and provided as Government-Furnished Property.

5. Selected Component Competition

As discussed previously, second sourcing of selected components are expected to reduce acquisition costs through competition.

6. Program Manager's Cost Curve

The program office wished to maintain at least the threat of competition even though this was theoretically a sole source. As part of the Cost Reduction Plan, the program office created a cost curve based on contractor cost estimates, Government estimates and potential saving from the cost reduction efforts. The purpose of this curve was to try to efficiently inject the threat of competition into a potential sole source procurement without the use of the limited competition arrangement of obtaining bids from the JV, TI and MM. The premise of this idea is that the mere

threat of competition between the two parties will lead to saving on the production contracts.

Performance at or below the PM cost curve estimate [see FIGURE 6] will preclude system competition as well as component breakout. However, a breach of the PM cost curve during any of the production runs, to include LRIP II and III, will result in the initiation and pursuit of competitive contracts for the remainder of the procurement. [Ref. 17:p. 7]

G. CHAPTER SUMMARY

This chapter presented a brief system overview of the Javelin weapon system as well as outlining the original acquisition strategy during the different phases. It also discussed why and how the program strategy was revised. Furthermore, it discussed the used of second sourcing at the subcomponent level to reduce cost and schedule. The cost reduction initiatives established by the program office were key ingredients to the revised strategy. FIGURE 7 provides a synopsis of the Javelin program history. This information lays the foundation of the program which will be used in the following chapter.

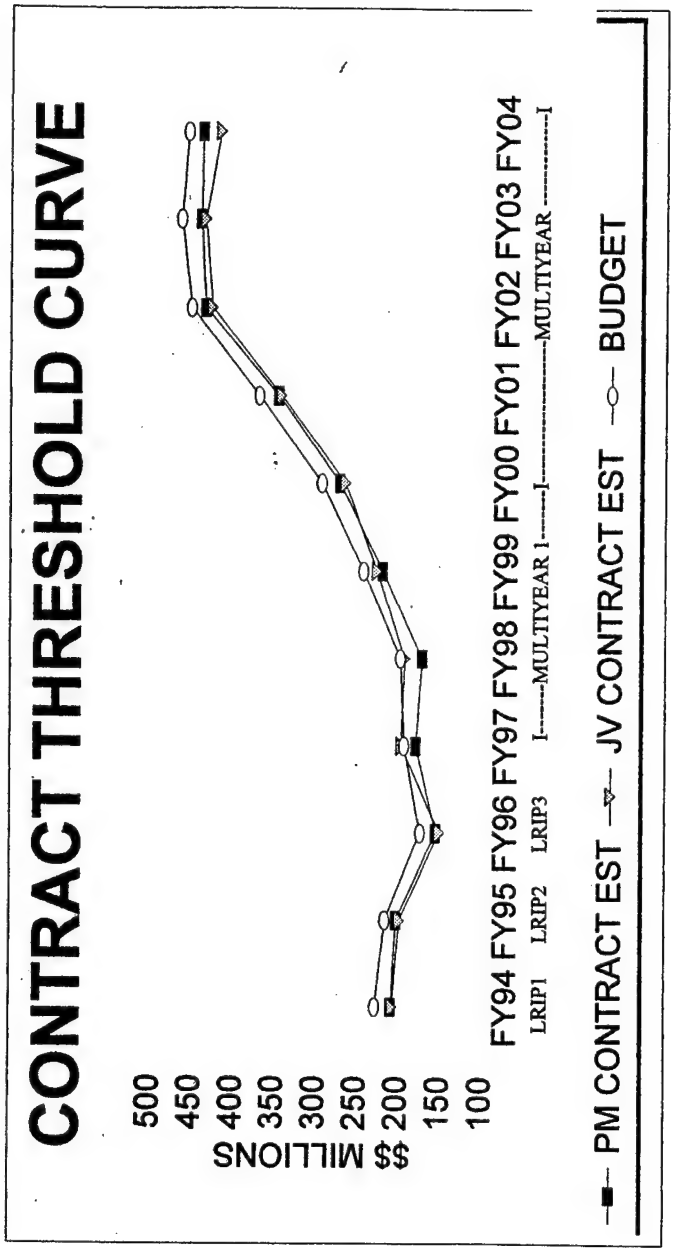

FIGURE 6 - Contract Threshold Curve

Source: [Ref. 17]

JAVELIN
TOTAL PROGRAM HISTORY

	MILESTONE II AUG 89	RESTRUCTURED PROGRAM FY91	DAB BASELINE FY94	CURRENT PROGRAM
PROGRAM LENGTH	6 YEARS	10 YEARS	14 YEARS	11 YEARS
TOTAL COST	3,389 M	4,475 M	4,666 M	3,293 M
TOTAL QUANTITIES				
- ROUND	70,550	70,550	31,269	31,269
- CLUs	6,486	6,486	3,166	3,264
ARMY QUANTITIES				
- ROUND	58,000	58,000	26,600	26,600
- CLUs	5,000	5,000	2,800	2,800
USMC QUANTITIES				
- ROUND	12,550	12,550	4,669	4,669
- CLUs	1,486	1,486	366	464

FIGURE 7 - Javelin Program History

Source: [Ref. 1:p. 13]

V. ANALYSIS OF THE JAVELIN WEAPON SYSTEM PROGRAM

A. INTRODUCTION

This chapter analyzes the PM's approach and strategy formulation at the program and critical component level. It also outlines the options the PM faced in realigning the dual sourcing strategy to combat the technological difficulties, force structure changes and budget cuts. It also looks at the advantages and disadvantages of the consolidated approach, as well as the use of the cost curve to invoke the threat of competition.

B. INITIAL STRATEGY FORMULATION

The first issue which must be addressed is whether or not the program strategy of dual sourcing is valid for this procurement. If it is valid, the question of the correct dual sourcing methodology must be considered. To accomplish this task, the SSMSM (pre-production) model is used.

The advantages of competition outlined in Chapter II endorse the need for more than one source in this procurement. This weapon system is to serve as the Infantry's primary weapon against an armored threat. It must be a quality product capable of evolving with the mission. As with the Dragon, once fielded, the system will most likely be in the Army's inventory for many years.

Having more than one source, competition, will provide a higher quality product and potential product improvement with a lower life cycle cost. This advantage of competition was discussed in Chapter II, section C, subsections two, four and seven.

With the large quantities initially projected, price was also an issue. Having two sources competing against each other would help drive prices down. This is a fundamental advantage of competition as discussed in Chapter II, section C, subsection one. Since this weapon system consists of an expendable round, the industrial base and ability to quickly produce large quantities in wartime remains a key for two sources.

With the initial quantities and short production schedule, the disadvantage of economies of scale would not significantly affect the procurement. Each competitor would be able to produce a quantity large enough to allow them to take advantage of learning rates and lower unit costs through bulk buys. Likewise, increased costs of maintaining two contractors was outweighed by the advantages of the expanded industrial base, as well as, reduction in schedule and technical risk.

In retrospect, knowing that the quantities were reduced and the production extended to 14 years, dual sourcing may

not make as much sense. Many of the advantages above become disadvantages, and the argument for a sole source based upon the factors first documented in the RAND study (Chapter III) become evident. For example, splitting production 60/40 with the reduced numbers identified with a 14-year production schedule would lead to inefficient use of production capacity which would lead to increased indirect costs.

If the program office had expected the possibility of quantity reductions and an extended production period, then the teaming arrangement most likely would not have been used. It is entirely feasible that the EMD contract would have been let with just TI. The program office verified this argument stating, "If the quantity reductions and production increase had been known, we would have gone with TI as a sole source". [Ref. 14] However, if the teaming arrangement had not been used, some of the influences which jeopardized the survivability of the program would have surely killed the program. These include most notably, TI's lack of ability to produce a FPA which met requirements as well as technical expertise in other areas offered by MM. Therefore, based on this analysis, this author supports the selection of dual sourcing as the primary acquisition strategy.

The methodology of CCT can quickly be analyzed by using the SSMSM model. This procurement initially was for a large quantity procured during a short period. The method chosen during POP was a technically complex, state-of-the-art system with no real commercial application. Since technically complex items tend to have a steeper learning curve, it is reasonable to expect that the learning curve for Javelin would be steep. According to the PMO, it was also expected that tooling costs would be low.

The degree of private research and development for this product was minimal, and the CPIF contract type placed the majority of the risk and cost on the Government. Additionally, each of the contractors who competed in the POP had the excess capacity to produce the system in-house with minimal subcontracting. Since the missile was considered a wooden round with no field level maintenance and minimal CLU maintenance, the maintenance requirement for this system is minimal. FIGURE 8 outlines the SSMSM (pre-production) model along with the categories described above. Looking at the model, it can be seen that the categories of quantity, other applications, tooling costs, maintenance requirement, and degree of subcontracting are all a wash. That is they are positive for each methodology, so they

Variables		F[3]	TDP	DL	L/F	CT
Quantity	High	+	+	+	+	+
Duration	Short	0	0	X	X	0
Learning Curve	Steep	-	-	-	0	0
Complexity	High	0	X	+	+	*
State of the Art	Yes	0	X	+	+	*
Other Application	No	+	+	+	+	+
Degree of Private R&D	Low	+	0	+	+	+
Tooling Costs	Low	+	+	+	+	+
Contractor Capacity	Excess	-	-	-	-	-
Maintenance Requirement	Significant	X	0	0	0	0
Degree of Sub-Ktring	Heavy	0	-	-	-	-

FIGURE 8

provide no distinction between choices. Likewise the category of contractor capacity is a negative for each category. It is also a wash, and will not be considered.

According to the model, the methodologies of DL and L/F are particularly inappropriate for this procurement. This

is due to the fact that the production phase was initially very short, six years. In that amount of time, it is very difficult to use these two strategies to provide a second source. By the time the second source would have been brought on line, to include establishing the line, learning rate, solving production difficulties, and qualification, the procurement would have been well over half way complete.

The TDP is inappropriate due to the technical complexity and state-of-the-art of the procurement. These two factors drive the need for cooperation between the original source and the second source. Difficult concepts may be hard to put on paper in a way that another source can decipher. Furthermore, it is more difficult to discern what requirements the PM should place on the contractor to ensure the TDP is complete. TDP does not provide the liaison needed for a system of this nature.

This leaves two methodologies, F^3 and CCT. Both rate the same in the areas of duration and degree of private R&D. However, CCT is particularly well-suited for this procurement due to the system's complexity and state-of-the-art. With a technology on the cutting edge, CCT provides the liaison really needed to transfer complex ideas and details from one party to another. This, of course, is assuming the partnership is well-established and information

sharing takes place as planned. Additionally, with two contractors working on the procurement as a team, each is capable of taking advantage of the assets of the other. CCT also consolidates the development effort thus reducing the development. Using F^3, development costs could be doubled due to two separate and complete development efforts. The use of CCT over F^3 also reduces the need for exact and clear specifications, without which could lead to two very distinct products under F^3. Specifications of this exactness are very difficult to nail down when dealing with leading edge technology.

Based on the initial requirements known in 1986, dual sourcing using the strategy of CCT at the program level was a valid choice. It provided the best advantages of the available choices as explained above, and ensured competition throughout the acquisition cycle. F^3, although not the best choice, does offer an alternative approach. The program office used a form of F^3 to transfer the technical information between the team members. F^3 is also used to second source critical components. This is a great use of F^3. The second source does not require the technical understanding of the complete system. F^3 of these items, considered potentially risky, allows for consecutive

development efforts. Thus, if one effort fails, the entire program does not.

C. DEM/VAL AND FLY-OFF

The use of competition was a critical component of the DEM/VAL phase. As described before, a POP was used in this phase to enhance design competition and demonstrate performance. In theory the competition and proven performance should have decreased development risk in EMD. This is particularly true considering the winner of POP entered a teaming arrangement for continued development. The answer to whether the POP did accomplish this task is beyond the scope of this study. The POP was accomplished with minimal incident; therefore, it is unclear whether the technical difficulties experienced in the EMD phase would have been greater had a POP not been conducted.

One key point of this phase is the fact that the participants knew in advance that source selection and continuance in the program required entering a teaming arrangement. This requirement was laid out in the initial RFP. Therefore, each participant entered DEM/VAL well aware of this requirement. This provided time for each participant to evaluate their product's weaknesses, and choose a partner accordingly.

D. EMD

1. Introduction:

A joint venture established under the confines of quickly producing large quantities provides the program manager flexibility and risk reduction not shared by any other strategy. However, it is also dangerous for a PM to not be prepared for disaster. This disaster happened in the Javelin program.

Although the technology of this program was state-of-the-art, the PM categorized the technical and schedule risk as low to moderate. This categorization was due primarily to the proven technology demonstration during POP. However, weight, FPA, ESAF and other problems surfaced early in EMD. These technical problems quickly lead to cost escalation which threatened the program's existence.

The whole premise of establishing the acquisition as a joint venture was impeded when the force reduction and budget cuts forced the realignment of the production schedule. The program office was stuck with an acquisition strategy not designed for this type of environment. Options were limited.

2. Joint Venture Realignment

The program office now faced a situation where, due to the smaller quantity purchases over an extended period

coupled with rapidly increasing development costs, a competitive split production and maintenance of two sources could actually increase unit costs above that of a single source. These challenges lead to a revision of the joint venture strategy. Three basic options were available: continue the acquisition as planned; maintain the joint venture, however, compete for all or nothing during production; and maintain the JV throughout production, better known as consolidation.

The first option of continuing as planned did offer the advantages of a second source for industrial mobilization, competition in each production run and continued receptiveness to the concerns of the buyer. However, due to limited production quantities each year, many of the advantages originally considered in this approach could not be realized. As mentioned earlier, the question of economy of scale, learning curve rates and increased investment costs could actually increase the unit price of the product beyond that of a single source.

The second option of competing the production as an all or nothing buy also presented some problems. Originally the plan called for each team member to produce a minimum of 10% of the production quantity during low rate initial production (LRIP) I and 50% during LRIP II. This would

qualify each producer. The FRP quantities would then be competed on a 60/40 split where the winner would produce 60% and the loser 40%. The all or nothing concept if imposed prior to LRIP I could destroy the TI/MM team arrangement since neither TI nor MM would likely continue if at least a minimum sustaining rate of production was not guaranteed. Furthermore, it would diminish technology transfer between the team members and foster an atmosphere of distrust and non-cooperation. Although some technology transfer did take place during EMD, each company developed specific portions of the weapon system and gained expertise in that area. Additionally, production lines and equipment had already been established in each of the plants based on EMD duties. Moving this equipment or establishing the line in the other plant could prove costly.

If the all or nothing approach was pursued after LRIP II, the head-to-head competition would likely be fierce thus driving down the unit price. However, it is unclear whether the savings would offset the costs already incurred in establishing two production lines during LRIP. Also, it is very probable that the losing team member would not maintain the expertise, equipment and production space to compete in the out years. This could mean a sole source procurement

after the initial FRP thus allowing the remaining team member to increase the price.

Option three maintained the JV throughout the entire production period. Although this consolidated approach is considered a sole source strategy, it does offer some distinct advantages. Operating as a single entity, each team member can continue to function as a subcontractor of the JV. This allows the specialization in their particular area of expertise to continue. Furthermore, as a single entity the JV can continue to take advantage of economies of scale, learning curve rates, fewer burdens and decreased investment costs. By having only one entity to deal with, the oversight and support required by the PM office are also reduced. Only one team is needed as opposed to one for each contractor. According to numbers estimated by the PM office, these efforts correspond to reduced acquisition costs in the area of 20 to 25 percent.

The consolidated approach provides advantages in other areas also. Cost savings in lot acceptance testing are realized. Since there is only one source, only half the number of missiles are consumed in lot testing. If TI and MM each produced a complete system, each would have to be tested to ensure acceptance. With the two companies not worried as much about future competition on this

procurement, more cooperation between the two can be realized. Advancements in cost reduction programs, value engineering, and enhanced preplanned product improvements benefit from the "working together" of the team as one entity, with one objective.

There are disadvantages to this approach however. There is no verification that each contractor is capable of producing the entire product. Although not critical right now, this is a key consideration in time of mobilization since large quantities could be required. Furthermore, since each contractor does not possess the established line to produce the entire weapon system, mobilization efforts could take some time while the equipment and assets are assembled.

Management loyalty is another question to be considered. Although members of the joint venture, allegiance still lies with the parent company. If each company is not committed to the joint venture, the efforts of the joint venture managers could thwart the success of the endeavor. Lastly, the problem of competition and ensuring a fair and equitable price remains since this is a sole source. This consolidated approach also mandates that the PMO seek approval through the proper channels for a sole source procurement.

E. SECOND SOURCING OF CRITICAL COMPONENTS

Five components were second sourced in the Javelin program. The idea behind this strategy was to reduce cost, schedule and performance risk by having two sources for these items. All five of the items were second sourced using F^3.

This use of F^3 for these items was critical to the survival of the program. Since many of the capabilities of this program are unique, the use of F^3 on critical pieces offered the advantage of marketplace innovation. Firms, having only performance specifications, were allowed to pursue their own approach in meeting the requirements.

The other approaches such as L/F, DL and TDP did not offer the same advantage of marketplace innovation that F^3 did. These approaches provide instructions on building a product which has already been produced and proven. There was not a product or proven design specification available for these critical items which had been proven to work. F^3 provided this acquisition something that none of the other techniques could, risk reduction in critical component development.

The best example of the advantage second sourcing played in the Javelin program is the FPA. FPA was identified as the premier technical risk of the system.

TI's inability to produce a FPA which could meet the performance specifications not only caused development costs to skyrocket but also lead to program delays. These rising costs almost lead to program cancellation. Fortunately for the program, F^3 specifications had already been given to SBRC by MM in preparation for production, and SBRC had developed a FPA which was ready for testing. SBRC's FPA was tested and found to exceed all thresholds established for the LRIP FPA. They in turn provided all FPA's required under the EMD contract.

This is a fine example of a key advantage which second sourcing can still provide acquisition professionals at all levels. Risk reduction through the use of second sourcing critical components, beginning in the development phase, paid large dividends for Javelin. When weighed with the option of possible program cancellation, the payoff of carrying two sources for these items is minimal.

The second sourcing also offered another advantage to the program in the case of the FPA. In 1991 when it was identified that the FPA was a driving force behind sky rocketing unit costs, the Defense Acquisition Board issued an ultimatum that the unit cost of the FPA must fall below $12,500 by LRIP II or the procurement would be terminated. The first FPAs delivered by SBRC, in EMD, were well over

this amount. It appeared that SBRC would not meet the $12.5 thousand unit cost goal.

Since the second source requirement still remained for the FPA, because of its criticality, a solicitation was issued for another producer using F^3. Loral won the contract and quickly engineered its own FPA. This FPA was available for LRIP II. The competition between SBRC and Loral lead SBRC to reduce its price below the $12,500 threshold.

F. PRODUCTION

1. Introduction

The JV strategy focused on competition in the production phase, but the restructuring which took place in the EMD phase left the program office with a "team of one". The program office turned its attention to developing options to create competition. OSD outlined a plan of soliciting bids from the JV, TI and MM. However, since MM and TI seemed satisfied with the JV arrangement, there was a chance of collusion or less drastic measures which could be taken by the parties to ensure the JV provided the best bid.

The PMO knew that an innovative approach was needed to ensure the Government received a fair and equitable price from the JV. Furthermore, without competition, production cost savings initiatives needed to be analyzed.

2. Enhanced Producibility Program Savings

The program office instituted numerous steps to reduce production costs. These costs were supposed to have been controlled by competition between the teams. However, now with the acquisition strategy pursuing only one production competitor, other measures were needed.

The enhanced producibility studies provided the JV money to investigate not only more efficient ways to produce items, but also insight to possible future product improvements. The success generated by EPP I and EPP II along with the threshold curve are the primary evaluation criteria which the program office plans on using to determine whether system competition will be pursued.

The use of EPPs in this program provided reduced production costs. However the use of EPPs can lead to this advantage in any program whether there is competition or not. In programs without competition though, EPPs are a valid cost reduction measure which the PM should consider.

3. Cost Threshold Curve

One of the primary reasons the program office established a dual source acquisition strategy was to ensure competition in the production phase. Now, after years of banking on savings in the production phase brought about by competition between TI and MM, they faced a situation of one

source. It appeared that the pay off of carrying two sources through EMD may be lost. The problem was, how to obtain the benefits of competition when there are two contractors in a teaming arrangement but really only enough production requirements for one.

The program management office did have a few factors working in their favor. First of all, the team members are happy with the JV arrangement. Each has specific duties in the production of the weapon system, and is comfortable with those duties only. By not producing the entire weapon system, each company has available production capacity to enter other markets. Secondly, the possibility of competition, although not cost effective for the Government, remains a threat to the contractors. If competition is sought, as discussed earlier, to be cost effective it would probably end in an all or nothing award and the exit of one of the team members from the market. Thus as long as the two members view the partnership as advantageous the PMO can use this to their advantage.

The use of the cost threshold curve identified in FIGURE 6 is the PMO's solution to "competition without competition". This unique approach enables the Government to maneuver itself into a position of negotiating as if competition is involved. As long as the JV remains under

the cost curve estimate of the PM, the production will continue as a consolidated effort.

This approach is different from the Office of the Secretary of Defense recommendation of competing the JV, MM and TI against one another. In that approach the PMO relies strictly on bids obtained from the contractors. If the two are happy with the JV arrangement, then it is a given that the two separate bids from the team members are going to be greater than the JV bid. In this approach the PMO is being proactive in ensuring the contract price remains fair and reasonable.

G. SUMMARY

The acquisition strategy of dual sourcing to reduce risk and promote competition at the system level of the Javelin program went through radical changes due to the technical difficulties, force structure changes and budget cuts. It did however, provide significant advantages, possibly even program saving advantages, in the area of critical components.

It is clear from this chapter that a program's acquisition strategy must be flexible enough to survive unknown influences. Furthermore, the PMO must be willing to use new and innovative approaches in order to successfully

achieve the mission of providing equipment in a timely and cost-effective manner to meet user requirements.

VI. CONCLUSIONS

A. CONCLUSIONS

There are many and varied reasons for a PM to consider dual sourcing as an acquisition strategy. These include but are not limited to: competition, increased industrial base, risk reduction, higher quality product and possibly reduced costs. However, merely wanting to achieve these objectives is not reason enough to choose dual sourcing. If it was, all programs would use this strategy. The PM must analyze the procurement profile to ensure that the benefits will not be outweighed by the disadvantages. Chapter III offers two approaches to this analysis.

The Javelin PMO analyzed the procurement profile of the weapon system prior to choosing the overall program strategy of teaming/joint venture. Large quantities, short production period and the political atmosphere lead to the decision of dual sourcing. The magnitude of the budget cuts and force restructuring, brought about by the collapse of the Soviet Union, in the 1990 was unforseen. These events, along with the technical difficulties experienced in the program, severely hampered any advantage which dual sourcing could offer.

In today's climate of national deficits, reduced budgets and an undefined threat, dual sourcing is quickly being abandoned as an overall program strategy to reduce costs. Every PM and acquisition official this author interviewed responded the same to the question of whether dual sourcing made sense in today's environment. The response was that no program around possesses the quantity requirements to make dual sourcing advantageous.

This author agrees that dual sourcing at the program level may not provide the advantage of cost savings in today's environment. However, the purpose of dual sourcing does not always lie in cost savings. Risk reduction is also a key advantage of dual sourcing, and this advantage is still very much achievable.

B. RESEARCH QUESTIONS

1. Primary Research Question

What were the lessons learned from the use of dual sourcing at different levels and stages in the Javelin program?

The PM of the Javelin program learned that an effective acquisition strategy is one which is first and foremost flexible. Over the life of an acquisition, developments in the environment can have a tremendous effect on program requirements. Large quantity requirements in the beginning

can change to smaller ones as the threat and budgetary constraints change. An acquisition strategy which cannot evolve to these changes severely limits the PM's alternatives and can lead to program failure.

If dual sourcing is chosen as the overall strategy, build in alternatives for a sole source procurement. Although Javelin planned on competition to mitigate costs during the production phase, quantity requirements did not allow for two separate sources. The Javelin PM had to seek other ways to meet cost goals. The cost threshold curve appears to provide the threat of competition which the PM wanted. This innovative approach in inserting a facet of competition into a sole source arrangement may provide other PMs an opportunity to rethink their teaming strategy in production. Quantity requirements are not the only thing that can leave a PM of a dual sourcing method with only one source. The PM for MILSTAR found himself in the same situation when one of the sources was unable to meet EMD requirements. Flexibility and innovation are imperative when using a dual sourcing strategy.

The benefit which dual sourcing played at the critical item level is unmeasurable. The availability of SBRC's FPA during EMD literally saved the Javelin program from cancellation. The availability of a second source for items

which are critical to a program's success reduces both schedule and technical risk. Furthermore, at the component level, quantities may still be great enough to provide a cost advantage. Even if cost reductions are not achievable for these items, the PM should consider the tradeoff of cost for risk reduction. The benefits may outweigh the costs.

A key lesson learned from the use of the joint venture strategy at the program level was that the use of a joint venture may provide advantages without seeking competition in the production phase. The primary reason for the use of dual sourcing at the program level in the 1980s was to develop a second source for competition in the production phase. Many PMs still consider this as the deciding factor on whether dual sourcing makes sense as a program strategy. The strategy of teaming/joint venture provided the Javelin program something that although expected, not considered the prime reason to seek a joint venture. This added feature was two independent entities, each with their own technical expertise, working together to solve state-of-the-art technical problems. Each team member has their own research and development assets, particular areas of know how and past products which when combined as a team can solve issues in a more efficient manner than one working alone.

2. Subsidiary Research Questions

a. Why is competition important in acquisition planning and strategy formulation?

This question is answered in Chapter II, Section C and D. It is important to plan for competition up front and early on. Not only is competition mandated in law, but the PM must consider its advantages and disadvantages to program success.

b. What is dual sourcing and when is its use advantageous in major systems acquisitions?

Dual sourcing, as well as the five techniques, is outlined in Chapter III. The advantages, disadvantages and proper uses of each methodology are explained. A PM must examine these advantages to decide whether dual sourcing is advantageous to his particular program. There are numerous methods available to do this. Chapter III briefly explains two of these methods.

c. How did the Javelin program office incorporate dual sourcing into its acquisition strategy?

The PM used dual sourcing in two primary ways. First of all, the overall acquisition strategy was set up along the teaming/joint venture arrangement. This approach was to begin no later than the EMD phase so that the team could

develop the product together and enter production with equal ability.

Secondly, the PM established second sources of critical components. The method chosen was Form, Fit, Function. Initially only two items were identified as critical, but as the program progressed other items were added to the list. This use of dual sourcing at both the primary and secondary level was key to the overall success of the program.

d. How can dual sourcing continue to provide benefits for Program Managers in programs like Javelin which undergo downsizing and budget cuts during program execution?

As explained above, dual sourcing can have a tremendous impact at the critical component level. All acquisition officials interviewed by this author agreed that a second source for critical components can still provide excellent advantages in today's environment. PMs should consider these items for second sourcing to reduce cost, technical, and schedule risk.

Dual sourcing, specifically teaming, is not useless at the program level although many believe this is true. Teaming may not make sense in today's environment of small quantity requirements since splitting production would lead to increased procurement costs. However, teaming offers another advantage if maintained as a sole source through

procurement. It pools the expertise of parties in different areas where a broad base of technical expertise is required. By pooling the expertise of different companies development time and costs may be reduced. Additionally, teaming may be used where two companies have complementary existing commercially developed products. Combining the two products with minimal additional development may provide the Government with a needed product quickly, and cheaply.

Teaming is particularly advantageous when dealing with state-of-the-art procurements where interoperability is an issue. Digitization and the Force XXI are a prime example. Teaming is being used in the digitization effort to incorporate the expertise of several producers.

Dual sourcing is not dead. It is still a viable option for PMs to consider. However, the rationale behind its use in the 1990s has evolved due to budgetary and quantity requirements. The future of this strategy option lies in its ability to provide risk mitigation for critical components, and as an aquisition multiplier at the program level by consolidating contractor's specific expertise to quickly develop technically complex equipment.

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